

# QUEST

ADVENTURES IN THE WORLD OF SCIENCE

## WATER OF LIFE 20



### FACT FILES ON:

- ▶ Power from waterfalls
- ▶ Deadly bacteria
- ▶ Dammed up energy
- ▶ Icebergs – the irresistible force
- ▶ Swimming for fitness
- ▶ Secrets of the water cycle
- ▶ Heavy water

**GIANT POSTER**

**SRN4 HOVERCRAFT**



**MAKE A  
CONDOR  
WAVEPIERCER**

**GROW  
CRYSTAL COLUMNS**

# INSIDE THIS PACK

## FACT FILES

- Liquid energy ► Water-borne germs ► Desalination ► Hydrotherapy ► Water's dynamic powers ► Sewage works ► Mining fossil water



**MODEL** Concorde Wavepiercer

## PROJECTS

- Make a stalactite
- Keep afloat
- Trace waterways



## POSTER

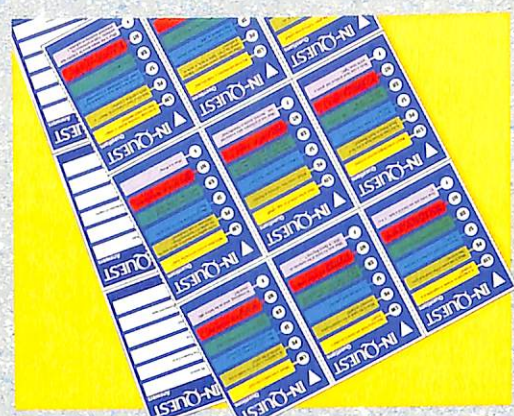


SRN4 Hovercraft

## DataQuest update PLUS



- FACT FILES INCLUDE:**
- Making pop videos
  - Breaking the sound barrier
  - Mixing tracks in the recording studio
  - Journey of a sound wave
  - Synthesizers



## POSTER

Backstage: profile of a rock concert



In-Quest question and answer cards ISSN 1350-3766





# PROJECTS

## CREATIVE FORCES

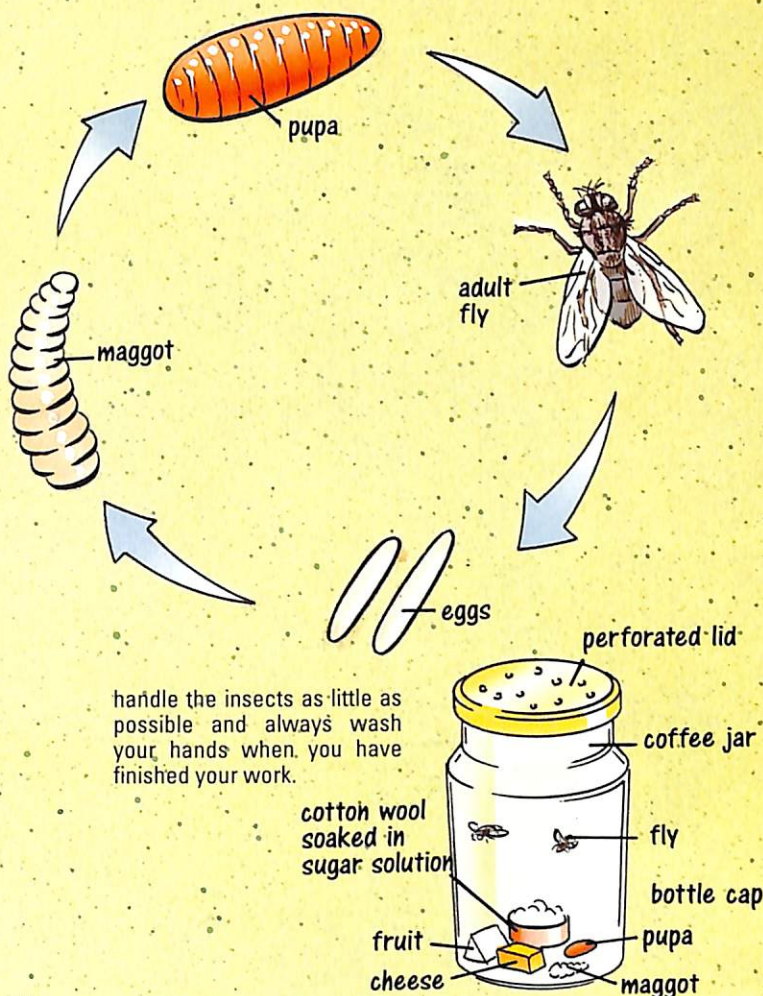
- Keep maggots in a glass jar and see how flies reproduce.
- How can you clone a plant with a simple cutting?
- Discover how to make delicious yoghurt from milk.

### LIFE CYCLE OF A FLY



Over a period of about two weeks you can observe the complete life cycle of the bluebottle.

Obtain eight maggots from a fishing shop. Take a small glass jar, cover the bottom with sawdust and punch a few small holes in the lid. Put the maggots in the jar with scraps of food and put it away in a dark place. After a few days the maggots will turn a red-brown colour and change into pupae. Clear the sawdust out and put a bottle top filled with cotton wool soaked in sugar water beneath one of the air holes. Add some pieces of ripe fruit, potato peelings and cheese, or even some meat. After a few days the adult flies will hatch out and several days later they will lay eggs. A few days later the eggs will develop into maggots. When you have seen all the stages in the life-cycle of the fly you should release all the eggs, maggots and flies outside the house. At all stages make sure that you



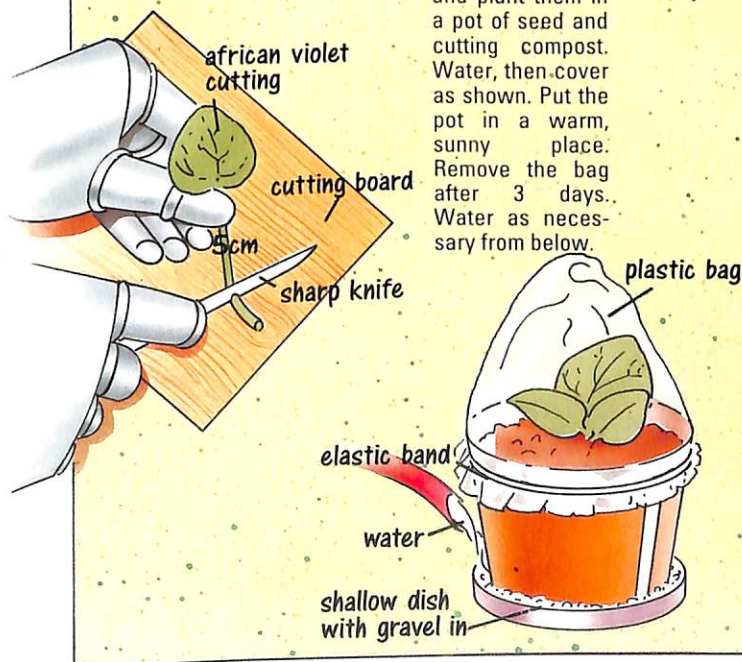
handle the insects as little as possible and always wash your hands when you have finished your work.

### CLONING PLANTS

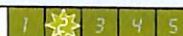


New plants grown from the cells of a parent plant are genetically identical and are called clones.

Cut three healthy, medium-sized leaves from an African violet. Trim the stem to 5 cm. Dip the stems in rooting powder and plant them in a pot of seed and cutting compost. Water, then cover as shown. Put the pot in a warm, sunny place. Remove the bag after 3 days. Water as necessary from below.

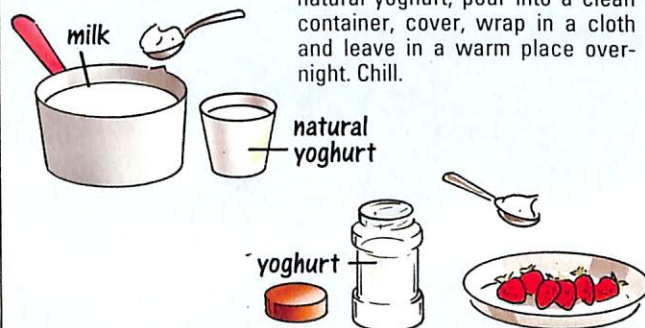


### MAKING YOGHURT



Yoghurt bacteria reproduce rapidly in warm milk. The bacteria produce an acid which clots and thickens the milk, making yoghurt.

Heat 250 ml milk until it steams. When lukewarm, stir in 2 tsp natural yoghurt, pour into a clean container, cover, wrap in a cloth and leave in a warm place overnight. Chill.



### PROJECT INFORMATION

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### WARNING!

Every care has been taken to ensure projects are as safe as possible. However, parents should supervise all projects. The publisher can accept no liability for any injury.

## CREATIVE FORCES: GESTATION PERIOD OF MAMMALS

MAMMAL	GESTATION (days)	NO. OF YOUNG			
Platypus	7-14	2-3 eggs	Baboon	187	1
House mouse	19	5-12	Fruit bat	190	1
		(several a year)	Giant anteater	190	1
Koala	30	1	Badger	200	2-4
Kangaroo	30-40	1	Aardvark	210	1
Rabbit	33	3-9	Chimpanzee	232	1
		(several a year)	Hippopotamus	233-240	1
Grey squirrel	40	3-7	Reindeer	240	1-2
		(twice a year)	Sea otter	240-270	1
House rat	42	5-10 (up to	American bison	270	1
		8 times a year)	Gorilla	270	1
Mongoose	49	2-4	Human being	270	1-6
		(twice a year)	Orang-utan	280	1
Dingo	63	4-5	Polar bear	280	1-4
Grey wolf	63	3-8	Walrus	330	1
Lynx	63	2-3	Blue whale (largest		
Wild cat	63-69	2-3	mammal ever)	330-360	1
Raccoon	65	3-6	Horse	337	1
Leopard	90-112	2-3	Dolphin	360	1
Cheetah	91-95	2-4	Porpoise	360	1
Hyena	92-98	2-4	Dromedary camel	365-440	1
Lion	102-113	2-3	Giraffe	400-468	1-2
Tiger	103-105	2-3	Sperm whale	420-480	1-2
Springbok	180	1	Black rhinoceros	450	1
Grizzly bear	180-240	1-4	African elephant	640	1

## INTO THE JUNGLE: PRINCIPAL JUNGLES OF THE WORLD

Indonesia	1,139,000 sq km	North Vietnam	135,000 sq km
Zaire	1,056,000 sq km	Thailand	83,000 sq km
Colombia	464,000 sq km	Nigeria	60,000 sq km
Papua New Guinea	342,000 sq km	Panama	42,000 sq km
Australia	242,915 sq km	South Korea	25,460 sq km
India	230,915 sq km	Bangladesh	22,800 sq km
Malaysia	201,915 sq km	Burma	22,800 sq km
Cameroon	180,000 sq km	Ghana	17,000 sq km
South Vietnam	150,000 sq km	Costa Rica	16,000 sq km
Suriname	148,000 sq km	Belize	14,000 sq km
Ecuador	142,000 sq km	Brazil	3,575 sq km
Cambodia	135,000 sq km	El Salvador	1,000 sq km

## LIGHT: LIGHT YEARS

Light travels at a speed of 300,000 km per second. Travelling at light speed, the Moon would be just 1.25 seconds away, and Pluto just eight hours.

### THE BRIGHTEST STARS

### DISTANCE FROM EARTH (light years)

Alpha Centauri	4.38	Capella	42.0
Sirius	8.6	Achernar	127.0
Procyon	11.4	Canopus	200.0
Vega	26.0	Beta Centauri (Agena)	490.0
Arcturus	36.0	Rigel	900.0

# Always Carried Away

When a plant reproduces, its seeds (or spores, in the case of fungi) must find their way to a new environment where there will be fresh supplies of water and soil nutrients. It is usually the shape of the 'fruit', which surrounds the seed, that determines the seeds' method of travel. (To a botanist 'fruit' includes such things as pods, gourds and nuts.)

- **The wind.** In some plants the fruits develop into feathery plumes, 'parachutes' or wings.
- **Water.** Plants such as mangrove trees and coconut palms launch their seeds on the rivers or sea, encased in buoyant gourds or shells.
- **Animals.** In the tropics, fruit bats eat mangos, guavas and breadfruit; in temperate climates, birds eat fruits such as blackberries and rose hips. Later the seeds are passed out in the birds' droppings and some grow where they fall. Many plants have sticky or prickly fruits that catch on the coats of animals and are carried for great distances.

Stephen Dalton/Alamy

## OCEAN CURRENTS

The fruits of Barringtonia trees are often seen floating in the Indian and Pacific Oceans. There are many types of Barringtonia, dispersed by the ocean currents throughout East Africa, India, Oceania and Australia. The fruits, called 'cut-nuts', provide food for local people. When a fruit has been washed on to a beach, as here in the Solomon Islands, the fruit begins to grow. The liquid in the fruit nourishes the plant, which grows up to 9 metres tall.



Wanna Cheng/Bruce Coleman Ltd

A puffball fungus, disturbed by wind, rain or an animal, gives out a cloud of spores that will drift to a new location on the forest floor.

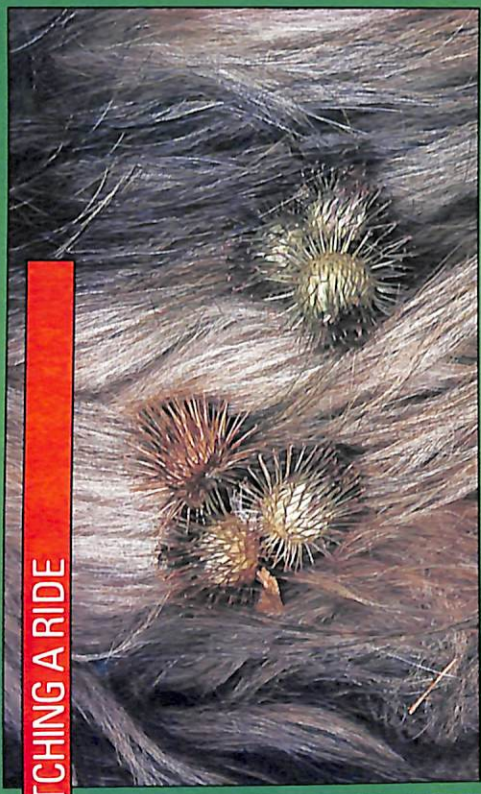
© G Lythgoe/Planet Earth Pictures



## TRAVELLERS' FARE

When a bird or animal eats an acorn, both parties benefit. The consumer gets the nourishment contained in the nut, while the seed within gets a free trip in the creature's stomach. In due course the seed is passed out in the animal's waste at some other location and begins to grow. Nuts are also kept in stores, or 'caches', by nuthatches, squirrels, jays and other animals and birds, to be eaten in winter. Some nuts are dropped in transit and get dispersed that way.

## HITCHING A RIDE



The fruits of many plants are equipped with prickly spines or hooks, designed to catch the coats of sheep and cattle – and they prove very tenacious when they catch in clothing. Prickly burrs of burdock (above) have caught in the long hairs of a dog's coat. The

hooks of another prickly plant, the cocklebur, can spoil the quality of sheep's wool. Other plant hitchhikers include goosegrass and enchanter's nightshade. Mistletoe seeds stick to birds' beaks when the berries are eaten and are later wiped off on tree bark.

## BORNE ON THE BREEZE

Many plants have seeds that float on currents of air. They include the dandelion, milkweed and rosebay willow herb. The familiar 'parachutes' of dandelion seeds can float 10km or more. The seeds of other plants, such as sycamore and ash, use a different method to 'fly'. They are supported by 'wings'.

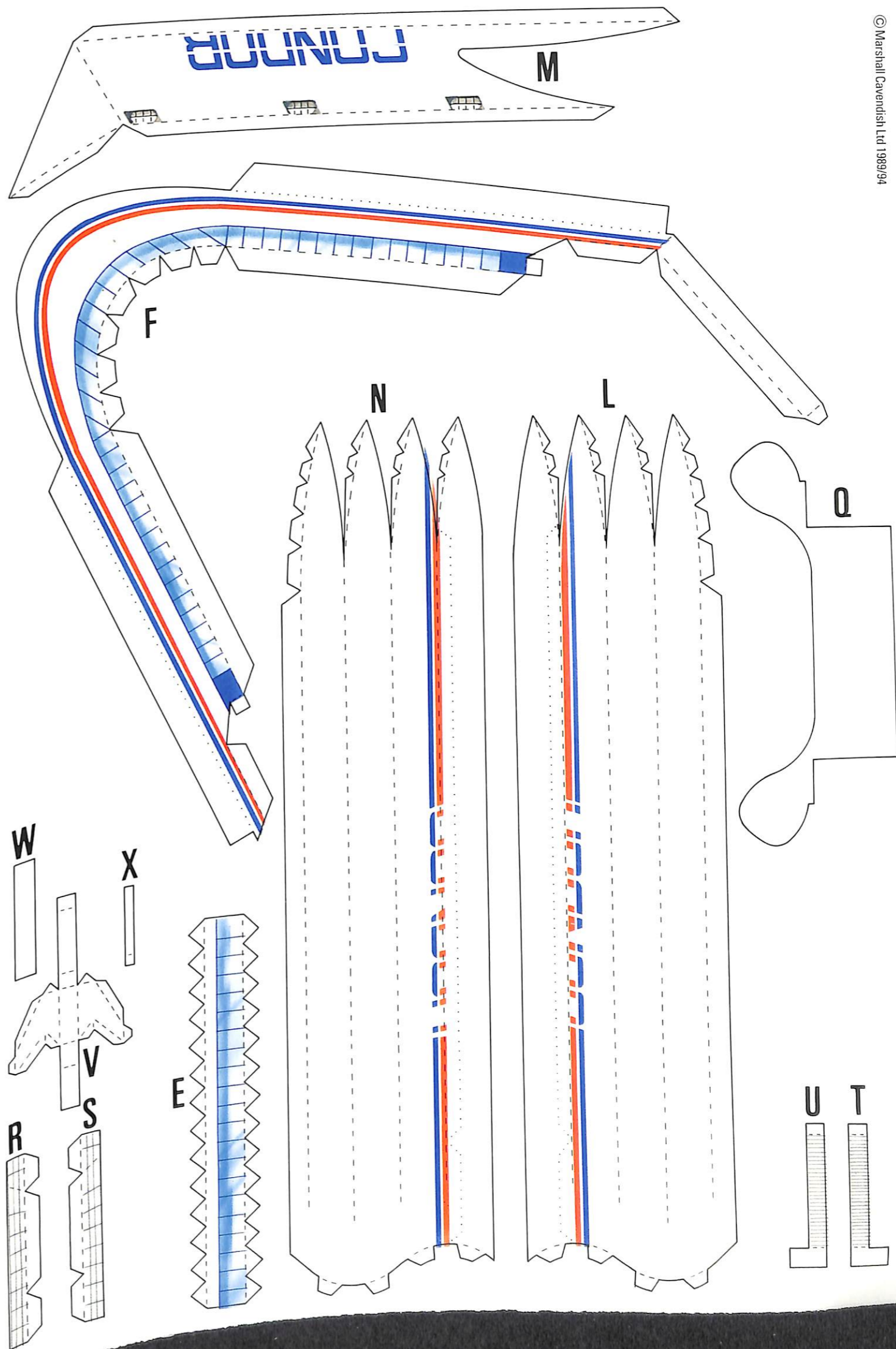
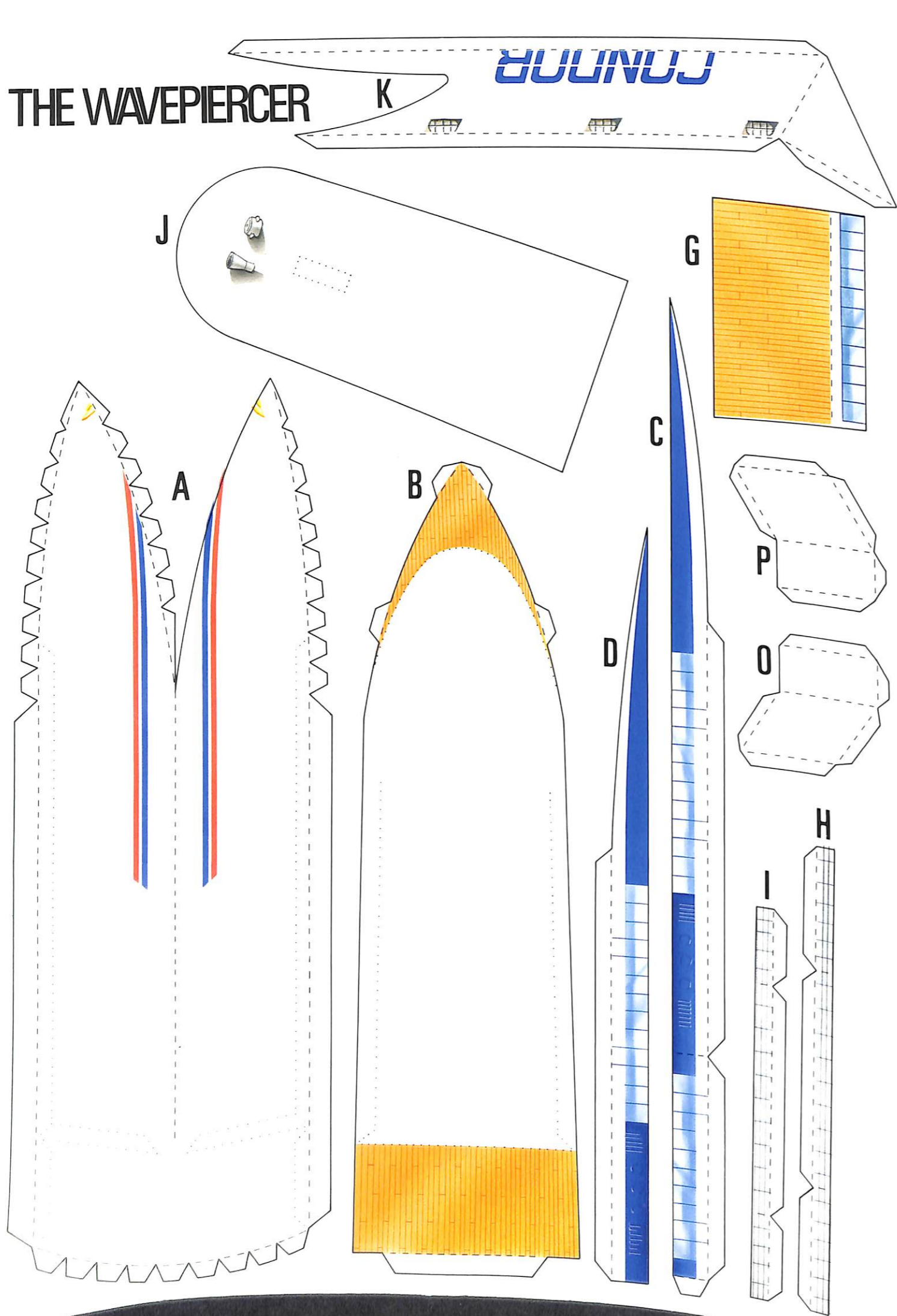


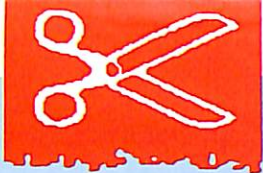
that whirl round and round, carrying the seeds a few metres downwind. Yet another principle is used by the numerous types of tumbleweed that grow in dry, windy regions. Their seeds develop inside light, balloon-like pods; these catch the wind and the seeds are scattered.

Breck P Kent/Oxford Scientific Films

Jane Burton/Bruce Coleman Ltd

# THE WAVEPIERCER





# MODEL

## ASSEMBLY INSTRUCTIONS

### THE WAVEPIERCER

#### You will need

Scissors • Ruler • Craft knife • Glue  
Before cutting out the pieces, score along all broken lines with a blunt edge and ruler to make folding and gluing easier. Study the ASSEMBLY DIAGRAM to see how the pieces fit together, and use dotted lines as a guide for positioning.

**NB** Younger children will need supervision when using a craft knife.

#### To make up

##### Main hull

- 1 Cut out hull **A**, using craft knife to cut round tabs. Fold tabs leaving bow (front) tabs up. Fold **A** along dotted line only, leaving stern (back) section to curve.
- 2 Cut out main deck **B**, and glue to long tabs on **A**. Glue tabs on front end of **B** inside bow of **A**.
- 3 Cut out starboard (right) side panel **C**. Fold for stern windows (see ASSEMBLY DIAGRAM). Fold in tabs and glue to inside of side panel using dotted line on **B** for position. Stick front of **C** to outside of raised tabs at bow end of **A**.
- 4 Cut out port (left) side panel **D** and glue to tab on stern windows, deck and bow as before.

##### Bridge

- 1 Cut out bow window **E**, fold tabs and glue to front of bridge **F**, white border facing down.
- 2 Glue tab on back of **F** to port side of **F**.
- 3 Apply glue to side tabs of **F** (up to dotted line) and tabs of **E** and stick to deck at dotted lines.
- 4 Cut out upper deck **G**, fold up stern windows and glue to tabs on **F** (see ASSEMBLY DIAGRAM).
- 5 Cut out upper deck guard rail **H**, fold tabs and glue to upper deck.
- 6 Cut out main deck guard rail **I**, fold each end at mark and glue to **B**.
- 7 Cut out wheelhouse roof **J** and glue to tabs on **F**.

##### Slender hulls

- 1 Cut out port slender hull support **K** and fold back at right angles. Fold tabs and glue to bottom of **A**; position using dotted lines.
- 2 Cut out port slender hull **L**, fold tabs in and glue into torpedo shape (see ASSEMBLY DIAGRAM).
- 3 Glue **L** to **K**.
- 4 Repeat for starboard hull support **M** and hull **N**.

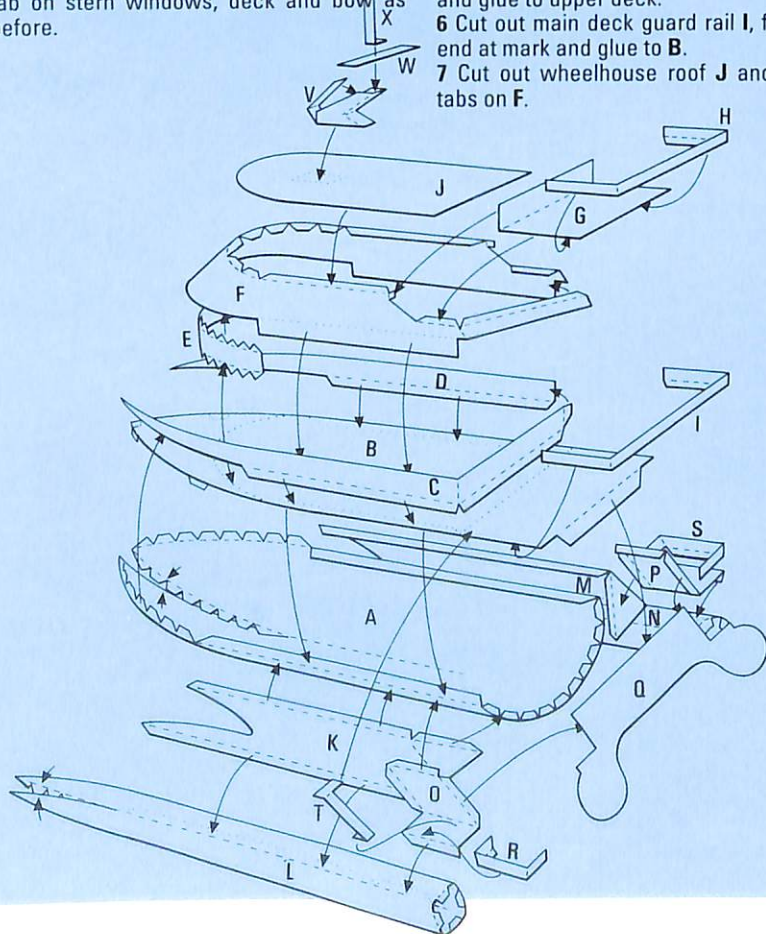
##### Stern

- 1 Cut out port stern panel **O** and fold along dotted line to make access platform. Fold tabs and glue to **A** and **L**.
- 2 Repeat with starboard stern panel and access platform **P**.
- 3 Cut out stern section **Q** and glue to tabs on back of **A**, to tabs on panels **O** and **P** and slender hulls **L** and **N**.
- 4 Cut out port guard rail **R**, fold in ends at right angles, fold tabs and glue around access platform (see ASSEMBLY DIAGRAM).
- 5 Repeat with starboard guard rail **S**.
- 6 Cut out port companion way **T**. Glue larger tab to main deck **A**, smaller tab to access platform **O**.
- 7 Repeat with starboard companion way **U**.

##### Radar

- 1 Cut out radar support **V**. Fold sides up and fold tabs. Fold back and glue longer strip to side tabs to make front of support. Fold up and glue shorter strip to side tabs to make back of support. When dry, glue support to roof **J** at marked position.
- 2 Cut out radar antenna **W** and glue crosswise on **V**.
- 3 Cut out radar aerial **X** fold tab and glue to centre of **W**.

**NB** Give your Wavepiercer a coat of clear varnish. When this has dried it will float in water.





# PROJECTS

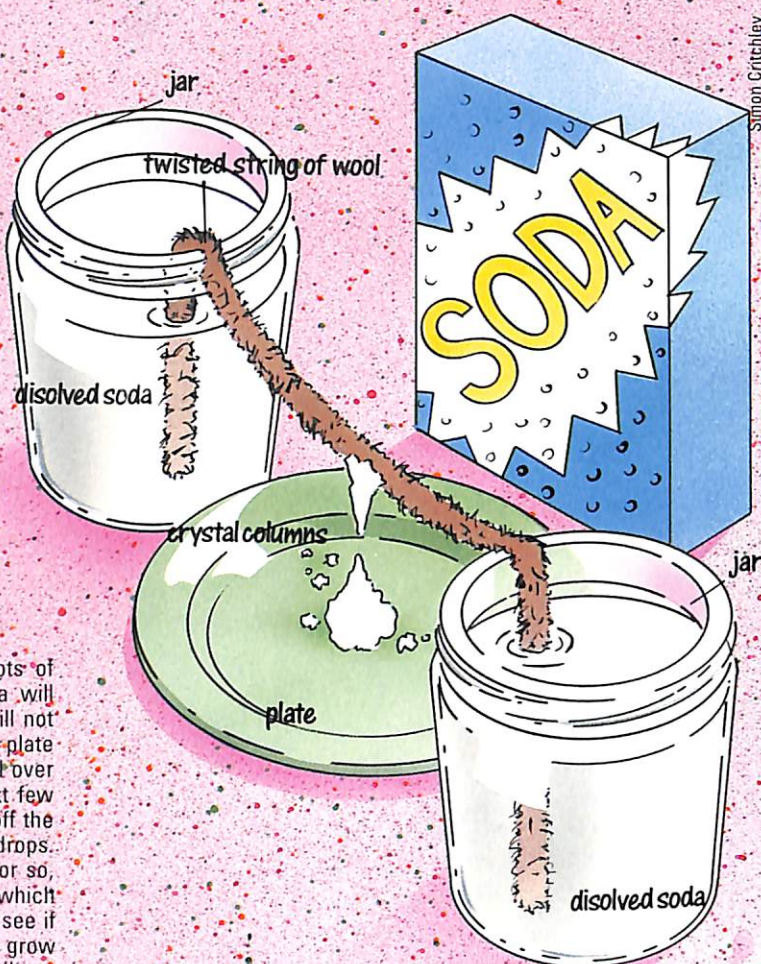
## WATER

- Make your own stalagmites and stalactites.
- Discover the best way to float in an emergency.
- Change the colour of a flower with food colouring.

### CRYSTAL COLUMNS 1 2 3 4 5

The pillars of crystals that grow in caves take hundreds of years to form, but you can make some in a few days.

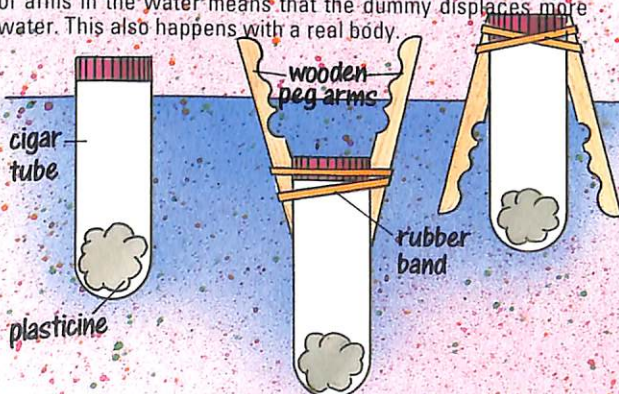
Take 4 pieces of wool, each about 35cm long, and twist them together to form a thick string. Fill two jars with very hot water from the tap then stir in lots of washing soda. Keep stirring it in until no more soda will dissolve. Put the jars somewhere warm where they will not be disturbed – an airing cupboard is ideal. Put a plate between the jars and hang the lengths of twisted wool over the plate with its ends in the solution. During the next few days water and soda will go along the wool and drip off the middle. As it drips the water turns into tiny, invisible, drops. These deposit crystals of soda which, after four days or so, form columns just like real stalagmites and stalactites, which can be seen in limestone caves. Wait a bit longer and see if the columns grow far enough to meet. The stalagmites grow up from the floor of a cave and the stalactites grow down from the ceiling.



### EMERGENCY FLOATERS 1 2 3 4 5

A person afraid of drowning usually waves his or her arms about, but this makes it harder to float as this experiment shows.

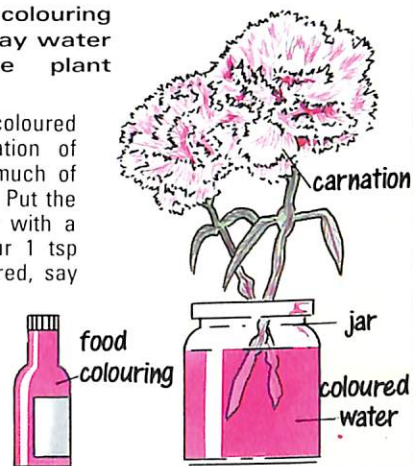
Put some plasticine into a metal or plastic cigar tube, screw the cap on and see how it floats in the bath, or sink. Add or take away plasticine until the tube floats upright with the top just level with the water. If necessary you can also add water to balance the tube. Wind a rubber band around the tube. Pull a wooden clothes peg apart, then push the two 'arms' under the band as shown. The top of the dummy will now be submerged. Remove the arms and push them into the band from below and try it once more. The dummy will now float with the cap clear of the water. This is because the addition of arms in the water means that the dummy displaces more water. This also happens with a real body.



### TRACING WATERWAYS 2 3 4 5

All plants need water to live. A little food colouring will reveal the way water passes up the plant stems.

Pick a white or light-coloured flower like a carnation of freesia, keeping as much of the stem as possible. Put the flower stem in a jar with a little water then pour 1 tsp of food colouring – red, say or blue – into the water. Leave overnight. Next day, veins in the stem and petals will show the water colour.



### PROJECT INFORMATION



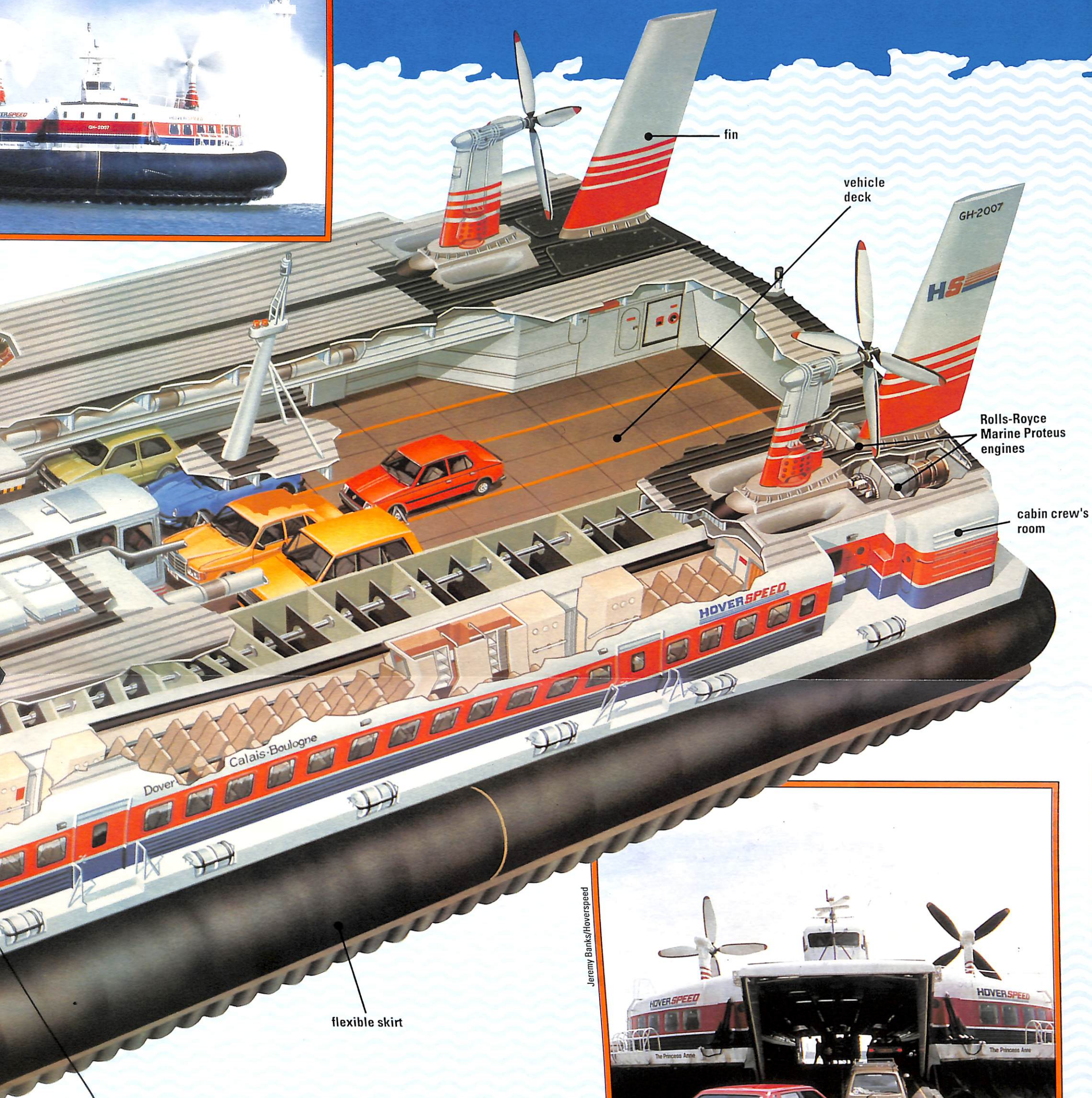
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*The Princess Anne can turn in its own length when manoeuvring in port, thanks to the reverse thrust that can be delivered by any of its four propellers.*



Jeremy Banks/Hoverspeed

*The giant hovercraft's flexible skirt is deflated while cars and lorries drive aboard. Once loaded, vehicles are lashed down while travellers go to the cabin.*



Hoverspeed

# NAIR

**HOVERCRAFT - VEHICLES FOR LAND AND SEA**

# PROFILE

## THE WORLD'S LARGEST HOVERCRAFT

The giant *Princess Anne* hovercraft speeds across the English Channel at over 100 km/h on a huge cushion of air, carrying a 112-tonne load. But it can travel over land as easily as over water – in fact it begins and ends each journey on a concrete apron. The craft is an SRN4 Mark 3, designed and built by the British Hovercraft Corporation. It is one of two identical SRN4 Mark 3s that operate on the Dover-Calais route. It is powered by four gas turbine engines at the rear. Each engine drives a propeller and a lift fan, which is mounted beneath the propeller. The lift fans drive air into the 'plenum', the space beneath the craft. There the air is retained by a flexible skirt. The air pressure builds up in the plenum, lifting the

craft three metres above the surface.

The propellers, made by Hawker Siddeley Dynamics, are the largest in the world used for propulsion (some larger ones are used on windmills). They have controllable pitch – that is, each blade can be swivelled in relation to its mounting, giving variable amounts of forward thrust, or even reverse thrust for braking or manoeuvring.

The skirt is a vital part of the hovercraft's design. Early skirtless craft could operate only in calm seas and could not cross obstacles more than 25 cm high. The double-walled skirt on an SRN4 enables it to negotiate high waves and soften their impact.

If the hovercraft has to stop while at sea – perhaps to offer assistance to a vessel in distress – it floats like an ordinary ship.

**Weight:** 300 tonnes fully laden.

**Capacity:** 55 cars and 390 passengers.

**Dimensions:** length 56.38 m; width 23.16 m; height of craft (skirt deflated) 11.43 m; height of inflated skirt 3.0 m.

**Engines:** four 3800-hp Rolls-Royce Marine Proteus gas turbines.

**Propellers:** four controllable-pitch type, measuring 6.3 m from tip to tip.

**Lift fans:** four 12-bladed centrifugal type, 3.5 m across.

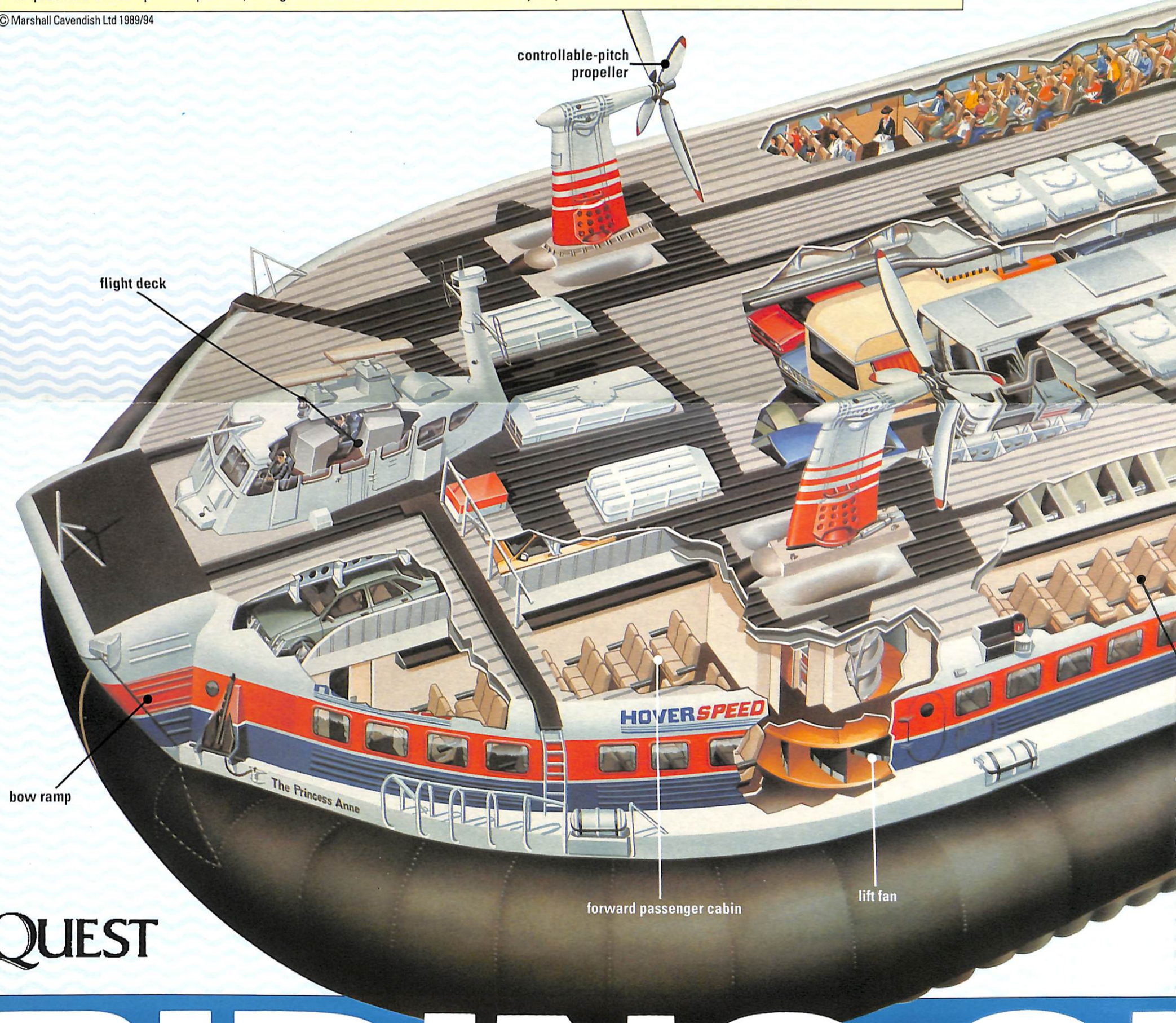
**Speed:** average 110-120 km/h (on calm water).

**Performance:** can operate in winds up to gale force 8.

**Endurance:** over 6 hours.

**Crew:** 18, including 3 on the flight deck, 8 cabin staff and 7 car deck hands.

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QUEST

# RIDING ON